

An On-Chip Nano-Plasmonics Based Urine Protein Assay Cartridge, Phase I

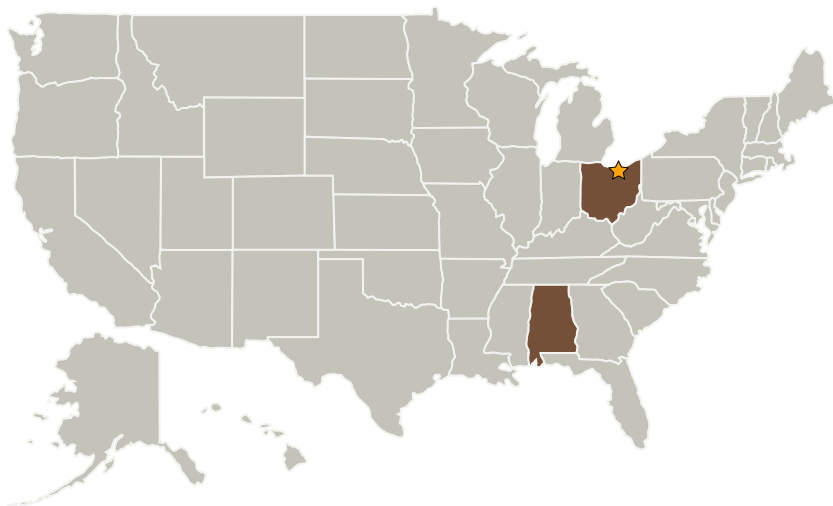
Completed Technology Project (2008 - 2009)



Project Introduction

Long-term exposure to microgravity and radiation during space exploration can pose a critical threat to the health of a flight crew. Real-time monitoring of urine protein levels is an effective way to follow the onset and progress of many diseases and guide the prompt selection of proper therapy. The success of such diagnostic tasks, which is strongly desired for flight missions, critically depends upon the degree of automation and reliability of such trace level detection. To meet this need, we propose to develop a novel on-chip, nano-plasmonic sensor cartridge to concurrently quantify the presence of different urine proteins. The envisioned device is compact, lightweight, fully integrated and automated, and highly cost- and power-effective. The program objectives will be accomplished via several innovations: (a) a new nano-plasmonics chip technology-based SPR sensor that is compatible with miniaturization, (b) tailored array modifications, allowing for concurrent screening of multiple proteins, (c) microfluidic platform for automated biochemical processes, and (d) simulation-based design for rapid prototype development. In Phase I, we will develop and demonstrate the critical microfluidic components (i.e., filter, mixer and network architecture) guided by physics-based simulations, and experimentally demonstrate the two-type-assay on a single nanoplasmonics chip for protein detection. The simulation-based design will conform to specifications that are amenable to mass-production-friendly lithographic techniques. In Phase II, the nano-plasmonic sensor will be optimized to increase sensitivity, stability, and the response to regular urine samples. Finally, the sensor will be integrated with microfluidic components and control/transmission electronics to form a portable protein assay cartridge.

Primary U.S. Work Locations and Key Partners



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Organizational Responsibility

Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

Lead Center / Facility:

Glenn Research Center (GRC)

Responsible Program:

Small Business Innovation Research/Small Business Tech Transfer

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| Organizations Performing Work | Role | Type | Location |
|-------------------------------|-------------------------|-------------|---------------------|
| ★ Glenn Research Center(GRC) | Lead Organization | NASA Center | Cleveland, Ohio |
| CFD Research Corporation | Supporting Organization | Industry | Huntsville, Alabama |

Primary U.S. Work Locations

| | |
|---------|------|
| Alabama | Ohio |
|---------|------|

Project Management

Program Director:

Jason L Kessler

Program Manager:

Carlos Torrez

Principal Investigator:

Jianjun Wei

Technology Areas

Primary:

- TX12 Materials, Structures, Mechanical Systems, and Manufacturing
 - └ TX12.2 Structures
 - └ TX12.2.3 Reliability and Sustainment